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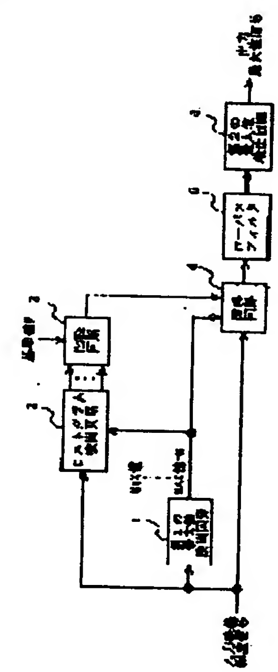
(54) IMAGE PROCESSING CIRCUIT AND IMAGE PROCESSING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To solve a problem that a sufficient gradation correction effect is not obtained when a display image includes information substantially independent of an original image such as a white letter such as a cinema letter and black level information for a banking period or the like in the case of carrying out gradation correction such as white level and black level expansion.

SOLUTION: A 1st maximum value detection circuit 1 detects a maximum value MAX of a received video luminance signal, a histogram detection circuit 2 detects a distribution of luminance signals at a value of (MAX-M) (where M is a prescribed value) on the basis of the detected maximum value MAX, a comparator circuit 3 calculates the difference from the detected distributions, a replacement circuit 4 replaces luminance signal levels from the MAX value to a value (MAX-M+1) with smaller levels when there exists a difference of a prescribed value W (where W is a reference value) or over, and a 2nd maximum value detection circuit 6 detects a maximum value on the basis of the signals after the replacement.



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CLAIMS

[Claim(s)]
[Claim 1] The 1st maximum detection means which is the image-processing circuit which detects the maximum intensity level of a subject-copy image from an input image luminance signal, and detects the maximum intensity level in display area from said input image luminance signal, In the intensity-level range containing said maximum intensity level detected by said 1st maximum detection means, and the intensity level of the near A histogram detection means to detect the amount of distribution of said input image luminance signal in each intensity level, A comparison means to judge whether information with said subject-copy image and said subject-copy image which exists in the left intensity level unrelated to said intensity-level range is included based on the amount of distribution detected in said histogram detection means, When judged with information unrelated to said subject-copy image being included by said comparison means A permutation means to permute the intensity level concerning the unrelated information concerned in said input image luminance signal by the intensity level which does not affect detection of the maximum intensity level of said subject-copy image, An image-processing circuit equipped with the 2nd maximum detection means which detects the maximum intensity level from the input video signal after the intensity level applied to said unrelated information with said permutation means was permuted.
[Claim 2] Said comparison means is an image-processing circuit according to claim 1 which computes the difference of the amount of distribution between the adjacent intensity levels in said intensity-level range, and is characterized by judging with information with said subject-copy image unrelated to said intensity-level range being included when the difference of the amount of distribution concerned is larger than a predetermined value.
[Claim 3] The image-processing circuit according to claim 1 characterized by containing the intensity level of one number of two - five pieces in said intensity-level range.
[Claim 4] The 1st minimum value detection means which is the image-processing circuit which detects the minimum intensity level of a subject-copy image from an input image luminance signal, and detects the minimum intensity level in display area from said input image luminance signal, In the intensity-level range containing said minimum intensity level detected by said 1st minimum value detection means, and the intensity level of the near A histogram detection means to detect the amount of distribution of said input image luminance signal in each intensity level, A comparison means to judge whether information with said subject-copy image and said subject-copy image which exists in the left intensity level unrelated to said intensity-level range is included based on the amount of distribution detected in said histogram detection means, When judged with information unrelated to said subject-copy image being included by said comparison means A permutation means to permute the intensity level concerning the unrelated information concerned in said input image luminance signal by the intensity level which does not affect detection of the maximum intensity level of said subject-copy image, An image-processing circuit equipped with the 2nd minimum value detection means which detects the minimum intensity level from the input video signal after the intensity level applied to said unrelated information with said permutation means was permuted.
[Claim 5] Said comparison means is an image-processing circuit according to claim 4 which computes the difference of the amount of distribution between the adjacent intensity levels in said intensity-level range, and is characterized by judging with information with said subject-copy image unrelated to said intensity-level range being included when the difference of the amount of distribution concerned is larger than a predetermined value.
[Claim 6] The image-processing circuit according to claim 4 characterized by containing the intensity level of one number of two - five pieces in said intensity-level range.
[Claim 7] An APL detection means to be an image-processing circuit for acquiring the maximum signal

suitable for the dynamic gradation amendment in an animation, and to detect the average intensity level in the display area of an input image luminance signal, An APL variation detection means to detect the variation of the average intensity level detected by said APL detection means, A maximum detection means to detect the maximum intensity level in the display area of said input image luminance signal, The maximum intensity level detected by said maximum detection means is controlled according to the variation of the average intensity level detected by said APL variation detection means. It has a filter means to output as said maximum signal. Said filter means When said variation is larger than the 1st predetermined value, said maximum intensity level is outputted as it is. The maximum intensity level outputted immediately before when said variation was smaller than the 2nd predetermined value is outputted fixed. It is the image processing system characterized by outputting said maximum intensity level followed according to the variation concerned when said variation is larger than said 2nd predetermined value and smaller than said 1st predetermined value.

[Claim 8] An APL detection means to be an image-processing circuit for acquiring the minimum value signal suitable for the dynamic gradation amendment in an animation, and to detect the average intensity level in the display area of an input image luminance signal, An APL variation detection means to detect the variation of the average intensity level detected by said APL detection means, A minimum value detection means to detect the minimum intensity level in the display area of said input image luminance signal, The minimum intensity level detected by said minimum value detection means is controlled according to the variation of the average intensity level detected by said APL variation detection means. It has a filter means to output as said minimum value signal. Said filter means When said variation is larger than the 1st predetermined value, said minimum intensity level is outputted as it is. The minimum intensity level outputted immediately before when said variation was smaller than the 2nd predetermined value is outputted fixed. It is the image processing system characterized by outputting said minimum intensity level followed according to the variation concerned when said variation is larger than said 2nd predetermined value and smaller than said 1st predetermined value.

[Claim 9] The 1st maximum detection step which is the image-processing approach of detecting the maximum intensity level of a subject-copy image from an input image luminance signal, and detects the maximum intensity level in display area from said input image luminance signal, In the intensity-level range containing said maximum intensity level detected by said 1st maximum detection step, and the intensity level of the near The histogram detection step which detects the amount of distribution of said input image luminance signal in each intensity level, The comparison step which judges whether information with said subject-copy image and said subject-copy image which exists in the left intensity level unrelated to said intensity-level range is included based on the amount of distribution detected in said histogram detection step, When judged with information unrelated to said subject-copy image being included by said comparison step The permutation step which permutes the intensity level concerning the unrelated information concerned in said input image luminance signal by the intensity level which does not affect detection of the maximum intensity level of said subject-copy image, The image-processing approach equipped with the 2nd maximum detection step which detects the maximum intensity level from the input video signal after the intensity level applied to said unrelated information by said permutation step was permuted.

[Claim 10] The 1st minimum value detection step which is the image-processing approach of detecting the minimum intensity level of a subject-copy image from an input image luminance signal, and detects the minimum intensity level in display area from said input image luminance signal, In the intensity-level range containing said minimum intensity level detected by said 1st minimum value detection step, and the intensity level of the near The histogram detection step which detects the amount of distribution of said input image luminance signal in each intensity level, The comparison step which judges whether information with said subject-copy image and said subject-copy image which exists in the left intensity level unrelated to said intensity-level range is included based on the amount of distribution detected in said histogram detection step, When judged with information unrelated to said subject-copy image being included by said comparison step The permutation step which permutes the intensity level concerning the unrelated information concerned in said input image luminance signal by the intensity level which does not affect detection of the minimum intensity level of said subject-copy image, The image-processing approach equipped with the 2nd minimum value detection step which detects the minimum intensity level from the input video signal after the intensity level applied to said unrelated information by said permutation step was permuted.

[Claim 11] The APL detection step which is the image-processing approach for acquiring the maximum

signal suitable for the dynamic gradation amendment in an animation, and detects the average intensity level in the display area of an input image luminance signal, The APL variation detection step which detects the variation of the average intensity level detected by said APL detection step, The maximum detection step which detects the maximum intensity level in the display area of said input image luminance signal, The maximum intensity level detected by said maximum detection step is controlled according to the variation of the average intensity level detected by said APL variation detection step. It has the filter step outputted as said maximum signal. Said filter step When said variation is larger than the 1st predetermined value, said maximum intensity level is outputted as it is. The maximum intensity level outputted immediately before when said variation was smaller than the 2nd predetermined value is outputted fixed. It is the image-processing approach characterized by outputting said maximum intensity level followed according to the variation concerned when said variation is larger than said 2nd predetermined value and smaller than said 1st predetermined value.

[Claim 12] The APL detection step which is the image-processing approach for acquiring the minimum value signal suitable for the dynamic gradation amendment in an animation, and detects the average intensity level in the display area of an input image luminance signal, The APL variation detection step which detects the variation of the average intensity level detected by said APL detection step, The minimum value detection step which detects the minimum intensity level in the display area of said input image luminance signal, The minimum intensity level detected by said minimum value detection step is controlled according to the variation of the average intensity level detected by said APL variation detection step. It has the filter step outputted as said minimum value signal. Said filter step When said variation is larger than the 1st predetermined value, said minimum intensity level is outputted as it is. The minimum intensity level outputted immediately before when said variation was smaller than the 2nd predetermined value is outputted fixed. It is the image-processing approach characterized by outputting said minimum intensity level followed according to the variation concerned when said variation is larger than said 2nd predetermined value and smaller than said 1st predetermined value.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] More specifically, this invention relates to the image-processing circuit and the image-processing approach of detecting the maximum intensity level of a subject-copy image from an input image luminance signal about an image-processing circuit and the image-processing approach.
[0002]
[Description of the Prior Art] Conventionally, this kind of image quality amendment circuit used the effective display period of a display screen as the sampling aperture, computed amendment data from that maximum and the minimum value, amended the input image luminance signal for every field or frame, and had realized high definition-ization.
[0003] Or it detects for every frame. for example, the minimum value and maximum of an image luminance signal within an effective display period -- every field -- The maximum of the detected input signal is changed into the maximum of the dynamic range of a video-signal processor (the maximum of the detected input video signal is changed into 255 in the 8 bit processing of digital one). When the minimum value of the detected input signal is changed into the minimum value of the dynamic range of a video-signal processor on the other hand (it usually changes into 0) and all the signals between the minimum value of an input luminance signal and maximum also carry out interpolation interpolation at linearity There was a method called the black stretching and white elongation which are amended so that all the dynamic ranges that a signal-processing system holds to any input signals may be exhausted. As for JP,10-248024,A, the example is indicated.
[0004]
[Problem(s) to be Solved by the Invention] In the above-mentioned example, in case the maximum and the minimum value for every field are detected, the information in Detection WINDOW is sampled equally. If data unrelated to an original image are inserted in the video signal afterwards, for example like the white title of a movie in case maximum is detected by such approach, the data inserted from next will be detected as maximum. In this way, since the level higher than an original image for whether your being Haruka is judged to be maximum and the above gradation amendments are performed based on this maximum, the amount of elongation in the case of performing amendment which elongates gradation in the white direction like white elongation will be stopped, and there is a problem that sufficient amendment effectiveness is not acquired.
[0005] Moreover, a luminance signal is usually about zero, the level below the black of an original image is judged to be black, elongation of the gradation of the direction of black is controlled, and the part besides the viewing area in a perpendicular direction has level and the problem that sufficient amendment effectiveness is not acquired, when the intensity level of this part is detected as the minimum value of an image.
[0006] So, in case the purpose of this invention performs gradation amendment which changes the maximum of for example, an image luminance signal into the maximum of the dynamic range of a video-signal processor, even if it is the case where a signal unrelated to an original image exists in a video signal, as sufficient gradation amendment effectiveness is acquired, it is offering the image-processing circuit and the image-processing approach the maximum of an original image is detectable.
[0007] By the way, in case gradation amendment of an animation is performed, opposite actuation [say / fluctuation prevention of the feature detection signal by minute change of a scene] is required as the flattery nature of a feature detection signal to the abrupt change of a scene at the time of the extract of the feature detection signal which shows the description of images, such as maximum in a viewing area, and the

minimum value. However, in the former, the highly precise correspondence to this technical problem was difficult.
[0008] So, the flattery nature to the abrupt change of a scene in case other purposes of this invention perform gradation amendment which changes the maximum of an image luminance signal into the maximum of the dynamic range of a video-signal processor as opposed to an animation, It is offering the image-processing circuit and the image-processing approach of amending the maximum used for gradation amendment to the optimal value according to change of a scene so that it can be compatible in the un-following nature to a minute change of a scene.
[0009]
[The means for solving a technical problem and an effect of the invention] The 1st maximum detection means which the 1st invention is an image-processing circuit which detects the maximum intensity level of a subject-copy image from an input image luminance signal, and detects the maximum intensity level in display area from an input image luminance signal, In the intensity-level range containing the maximum intensity level detected by the 1st maximum detection means, and the intensity level of the near A histogram detection means to detect the amount of distribution of the input image luminance signal in each intensity level, Whether based on the amount of distribution detected in the histogram detection means, information with a subject-copy image and the subject-copy image which exists in the left intensity level unrelated to the intensity-level range is included with a comparison means to judge, and a comparison means A permutation means to permute the intensity level concerning this unrelated information in an input image luminance signal by the intensity level which does not affect detection of the maximum intensity level of a subject-copy image when judged with information unrelated to a subject-copy image being included, It has the 2nd maximum detection means which detects the maximum intensity level from the input video signal after the intensity level applied to unrelated information with a permutation means was permuted.
[0010] As mentioned above, according to the 1st invention, to the image with which the information later inserted regardless of original images, such as a white alphabetic character of the title of a movie, is included, elongation of sufficient gradation of the white direction is enabled and effective gradation amendment is realized.
[0011] It is characterized by for a comparison means computing the difference of the amount of distribution between the adjacent intensity levels in the intensity-level range in the 1st invention, and judging the 2nd invention as information with a subject-copy image unrelated to the intensity-level range being included, when the difference of this amount of distribution is larger than a predetermined value.
[0012] As mentioned above, according to the 2nd invention, since the information and the subject-copy images of a title, such as a white alphabetic character, are distinguished based on the difference of the amount of distribution of each intensity level, it is hard to produce the distinction mistake by a noise etc., and a white alphabetic character etc. can be distinguished more correctly.
[0013] 3rd invention is characterized by containing the intensity level of one number of two - five pieces in the intensity-level range in the 1st invention.
[0014] As mentioned above, according to the 3rd invention, by doubling with intensity-level range, such as a general white alphabetic character, possibility of distinguishing a subject-copy image from a white alphabetic character etc. accidentally can decrease, and distinction precision can be raised.
[0015] The 1st minimum value detection means which the 4th invention is an image-processing circuit which detects the minimum intensity level of a subject-copy image from an input image luminance signal, and detects the minimum intensity level in display area from an input image luminance signal, In the intensity-level range containing the minimum intensity level detected by the 1st minimum value detection means, and the intensity level of the near A histogram detection means to detect the amount of distribution of the input image luminance signal in each intensity level, Whether based on the amount of distribution detected in the histogram detection means, information with a subject-copy image and the subject-copy image which exists in the left intensity level unrelated to the intensity-level range is included with a comparison means to judge, and a comparison means A permutation means to permute the intensity level concerning this unrelated information in an input image luminance signal by the intensity level which does not affect detection of the minimum intensity level of a subject-copy image when judged with information unrelated to a subject-copy image being included, It has the 2nd minimum value detection means which detects the minimum intensity level from the input video signal after the intensity level applied to unrelated information with a permutation means was permuted.
[0016] As mentioned above, according to the 4th invention, when information unrelated to original images, such as black level of the blanking section, has been detected, elongation of sufficient gradation of the

direction of black is enabled, and effective gradation amendment is realized.
[0017] It is characterized by for a comparison means computing the difference of the amount of distribution between the adjacent intensity levels in the intensity-level range in the 4th invention, and judging the 5th invention as information with a subject-copy image unrelated to the intensity-level range being included, when the difference of this amount of distribution is larger than a predetermined value.
[0018] As mentioned above, according to the 5th invention, since the information and the subject-copy image of a blanking part are distinguished based on the difference of the amount of distribution of each intensity level, it is hard to produce the distinction mistake by a noise etc., and a blanking part etc. can be distinguished more correctly.
[0019] 6th invention is characterized by containing the intensity level of one number of two - five pieces in the intensity-level range in the 4th invention.
[0020] As mentioned above, according to the 6th invention, by doubling with the intensity-level range of a general blanking part, possibility of distinguishing a blanking part from a subject-copy image accidentally can decrease, and distinction precision can be raised.
[0021] An APL detection means for the 7th invention to be an image-processing circuit for acquiring the maximum signal suitable for the dynamic gradation amendment in an animation, and to detect the average intensity level in the display area of an input image luminance signal, An APL variation detection means to detect the variation of the average intensity level detected by the APL detecting element, A maximum detection means to detect the maximum intensity level in the display area of an input image luminance signal, The maximum intensity level detected by the maximum detection means is controlled according to the variation of the average intensity level detected by the APL variation detection means. It has a filter means to output as a maximum signal. A filter means When a variation is larger than the 1st predetermined value, the maximum intensity level is outputted as it is. It is characterized by outputting the maximum intensity level outputted immediately before fixed, when a variation is smaller than the 2nd predetermined value, and outputting the maximum intensity level followed according to the variation concerned when a variation is larger than the 2nd predetermined value and smaller than the 1st predetermined value.
[0022] As mentioned above, according to the 7th invention, it makes it possible to be compatible in fluctuation prevention of the feature detection signal by minute change of a scene the flattery disposition top of the feature detection signal over the abrupt change of a scene. Therefore, the gradation amendment whose problem an animation does not have, either is realizable by losing the sense of incongruity by the delay of gradation amendment, and the flicker by fine vibration.
[0023] An APL detection means for the 8th invention to be an image-processing circuit for acquiring the minimum value signal suitable for the dynamic gradation amendment in an animation, and to detect the average intensity level in the display area of an input image luminance signal, An APL variation detection means to detect the variation of the average intensity level detected by the APL detecting element, A minimum value detection means to detect the minimum intensity level in the display area of an input image luminance signal, The minimum intensity level detected by the minimum value detection means is controlled according to the variation of the average intensity level detected by the APL variation detection means. It has a filter means to output as a minimum value signal. A filter means When a variation is larger than the 1st predetermined value, the minimum intensity level is outputted as it is. It is characterized by outputting the minimum intensity level outputted immediately before fixed, when a variation is smaller than the 2nd predetermined value, and outputting the minimum intensity level followed according to the variation concerned when a variation is larger than the 2nd predetermined value and smaller than the 1st predetermined value.
[0024] As mentioned above, according to the 8th invention, it makes it possible to be compatible in fluctuation prevention of the feature detection signal by minute change of a scene the flattery disposition top of the feature detection signal over the abrupt change of a scene. Therefore, the gradation amendment whose problem an animation does not have, either is realizable by losing the sense of incongruity by the delay of gradation amendment, and the flicker by fine vibration.
[0025] The 1st maximum detection step which the 9th invention is the image-processing approach of detecting the maximum intensity level of a subject-copy image from an input image luminance signal, and detects the maximum intensity level in display area from an input image luminance signal, In the intensity-level range containing the maximum intensity level detected by the 1st maximum detection step, and the intensity level of the near The histogram detection step which detects the amount of distribution of the input image luminance signal in each intensity level, Whether based on the amount of distribution detected in the histogram detection step, information with a subject-copy image and the subject-copy image which exists in

the left intensity level unrelated to the intensity-level range is included by the comparison step to judge and the comparison step The permutation step which permutes the intensity level concerning the unrelated information concerned in an input image luminance signal by the intensity level which does not affect detection of the maximum intensity level of a subject-copy image when judged with information unrelated to a subject-copy image being included, It has the 2nd maximum detection step which detects the maximum intensity level from the input video signal after the intensity level applied to unrelated information by the permutation step was permuted.

[0026] As mentioned above, according to the 9th invention, to the image with which the information later inserted regardless of original images, such as a white alphabetic character of the title of a movie, is included, elongation of sufficient gradation of the white direction is enabled and effective gradation amendment is realized.

[0027] The 1st minimum value detection step which the 10th invention is the image-processing approach of detecting the minimum intensity level of a subject-copy image from an input image luminance signal, and detects the minimum intensity level in display area from an input image luminance signal, In the intensity-level range containing the minimum intensity level detected by the 1st minimum value detection step, and the intensity level of the near The histogram detection step which detects the amount of distribution of the input image luminance signal in each intensity level, Whether based on the amount of distribution detected in the histogram detection step, information with a subject-copy image and the subject-copy image which exists in the left intensity level unrelated to the intensity-level range is included by the comparison step to judge and the comparison step The permutation step which permutes the intensity level concerning the unrelated information concerned in an input image luminance signal by the intensity level which does not affect detection of the minimum intensity level of a subject-copy image when judged with information unrelated to a subject-copy image being included, It has the 2nd minimum value detection step which detects the minimum intensity level from the input video signal after the intensity level applied to unrelated information by the permutation step was permuted.

[0028] As mentioned above, according to the 10th invention, when information unrelated to original images, such as black level of the blanking section, has been detected, elongation of sufficient gradation of the direction of black is enabled, and effective gradation amendment is realized.

[0029] The APL detection step which the 11th invention is the image-processing approach for acquiring the maximum signal suitable for the dynamic gradation amendment in an animation, and detects the average intensity level in the display area of an input image luminance signal, The APL variation detection step which detects the variation of the average intensity level detected by the APL detection step, The maximum detection step which detects the maximum intensity level in the display area of an input image luminance signal, The maximum intensity level detected by the maximum detection step is controlled according to the variation of the average intensity level detected by the APL variation detection step. It has the filter step outputted as a maximum signal. A filter step When a variation is larger than the 1st predetermined value, the maximum intensity level is outputted as it is. It is characterized by outputting the maximum intensity level outputted immediately before fixed, when a variation is smaller than the 2nd predetermined value, and outputting the maximum intensity level followed according to the variation concerned when a variation is larger than the 2nd predetermined value and smaller than the 1st predetermined value.

[0030] As mentioned above, according to the 11th invention, it makes it possible to be compatible in fluctuation prevention of the feature detection signal by minute change of a scene the flattery disposition top of the feature detection signal over the abrupt change of a scene. Therefore, the gradation amendment whose problem an animation does not have, either is realizable by losing the sense of incongruity by the delay of gradation amendment, and the flicker by fine vibration.

[0031] The APL detection step which the 12th invention is the image-processing approach for acquiring the minimum value signal suitable for the dynamic gradation amendment in an animation, and detects the average intensity level in the display area of an input image luminance signal, The APL variation detection step which detects the variation of the average intensity level detected by the APL detection step, The minimum value detection step which detects the minimum intensity level in the display area of an input image luminance signal, The minimum intensity level detected by the minimum value detection step is controlled according to the variation of the average intensity level detected by the APL variation detection step. It has the filter step outputted as a minimum value signal. A filter step When a variation is larger than the 1st predetermined value, the minimum intensity level is outputted as it is. It is characterized by outputting the minimum intensity level outputted immediately before fixed, when a variation is smaller than the 2nd predetermined value, and outputting the minimum intensity level followed according to the variation

concerned when a variation is larger than the 2nd predetermined value and smaller than the 1st predetermined value.

[0032] As mentioned above, according to the 12th invention, it makes it possible to be compatible in fluctuation prevention of the feature detection signal by minute change of a scene the flattery disposition top of the feature detection signal over the abrupt change of a scene. Therefore, the gradation amendment whose problem an animation does not have, either is realizable by losing the sense of incongruity by the delay of gradation amendment, and the flicker by fine vibration.

[0033]

[Embodiment of the Invention] Hereafter, the various operation gestalten of this invention are explained with reference to a drawing.

(1st operation gestalt) With the 1st operation gestalt, in order to use for gradation amendment, for example, when the maximum of an input image luminance signal needs to be obtained, since information, such as a white alphabetic character contained in an input image luminance signal, is temporarily permuted by level smaller than the maximum of an original image, the maximum of subject-copy image original is detected by detecting maximum. Drawing 1 is the block diagram showing the configuration of the gestalt of operation of the image-processing circuit concerning the 1st operation gestalt of this invention. An image-processing circuit is equipped with the 1st maximum detector 1, the histogram detector 2, a comparator circuit 3, the permutation circuit 4, a low pass filter 5, and the 2nd maximum detector 6. Hereafter, actuation of the 1st operation gestalt is explained.

[0034] An input image luminance signal is inputted into an image-processing circuit, and this input image luminance signal is inputted into the 1st maximum detector 1, histogram detector 2, and permutation circuit 4, respectively. The 1st maximum detector 1 detects the maximum of the intensity level in display area for every field and every frame based on an input image luminance signal. From this detected maximum (it considers as a MAX value below) to and a MAX value - The value of the intensity level to M is outputted to the histogram detector 2 and the permutation circuit 4, respectively. It is necessary to set up the value of M the optimal according to the brightness width of face of a white alphabetic character to detect. Usually, it becomes about two to five integer.

[0035] The histogram detector 2 is a MAX value from a MAX value which detects the luminance distribution information on an input image luminance signal, and is inputted from the 1st maximum detector 1. - The amount of distribution of the input image luminance signal in each intensity level to M is outputted to a comparator circuit 3, respectively. A comparator circuit 3 outputs the information, when there is a difference of the bigger amount of distribution than the reference value W which calculates the difference of the amount of distribution between adjacent intensity levels, respectively, and is set up from the outside. It is equivalent to detecting white alphabetic characters, such as a title, to detect the difference of this big amount of distribution. When the image with which white alphabetic characters, such as a title, are contained is inputted, as shown in drawing 2 , it is distributed over the intensity level separated from original image information with a certain amount of width of face. With this operation gestalt, a white alphabetic character is detected using the description of distribution of such an intensity level of an image that a white alphabetic character is contained.

[0036] Hereafter, the case where Above M is 3 is concretely explained to an example about detection processing of a white alphabetic character. From the histogram detector 2, the amount of distribution of a MAX value, the amount of distribution of (the MAX value -1), the amount of distribution of (the MAX value -2), and the amount of distribution that reaches (MAX value -3) are outputted, respectively. In a comparator circuit 3, it is based on these amounts of distribution. The amount of distribution of amount of distribution - (MAX value -1) of a MAX value (referred to as DEMAX1), The amount of distribution of amount of distribution - (MAX value -2) of (the MAX value -1) (referred to as DEMAX2), The amount of distribution (referred to as DEMAX3) of amount of distribution - (MAX value -3) of (the MAX value -2) is calculated respectively, and when the difference exceeding the reference value W set up from the outside is detected, it is judged that it is the information unrelated to images, such as a white alphabetic character, projected regardless of the image. Since a difference is between white text and the information on a subject-copy image just below in an intensity level, it is judged as a white alphabetic character. Above DEMAX3 is large enough, when it exceeds a reference value W, this information is outputted to the permutation circuit 4 from a comparator circuit 3, a MAX value, the MAX value -1, and the MAX value -2 are judged to be white text, and brightness permutes such signal level by sufficiently small level. As long as the level to permute does not perform gradation amendment near black, 0 is sufficient as it, and as long as it amends black, it may also choose a middle intensity level. After the output of the permutation circuit 4 is inputted into the

low pass filter 5 from which isolated-point information is removed and filtering is made, it is inputted into the 2nd maximum detector 6, and the maximum of a display image is detected for every field and every frame. In this way, an output maximum signal is outputted. As mentioned above, the maximum of subject-copy image original is detectable by detecting a white alphabetic character, permuting a white alphabetic character by level with low enough brightness, and detecting maximum again.
[0037] In addition, although the value of Above M used 3 in this example, it is necessary to set it up the optimal with the brightness width of face of a white alphabetic character to detect. Moreover, it is necessary to set up according to the intensity level of the white alphabetic character which wants to detect a reference value W. A low pass filter 5 may perform filtering only about either horizontal or a perpendicular direction, and may perform filtering in great numbers.
[0038] An example of gradation amendment using the maximum detected according to this operation gestalt is explained with reference to drawing 3 . In the gradation amendment shown in drawing 3 , a crease bending point is set up the optimal, and it amends so that the detected MAX value may turn into maximum of the dynamic range of a signal-processing system. It amends so that it may break into the correction value of maximum about the gradation from a crease bending point to a MAX value and a bending point may be connected. By this amendment, the gradation more than the maximum which originally was not used can be used effectively. That is, as shown in drawing 5 , input D range is expanded even to output D range. In such white elongation amendment, when a MAX value is detected more greatly than a subject-copy image by white text etc., the gradation which should be elongated decreases and the amendment effectiveness decreases.
[0039] As mentioned above, according to the 1st operation gestalt, though information, such as a white alphabetic character, was included in the video signal, it becomes possible to detect the maximum of subject-copy image original. Therefore, if the maximum obtained according to this operation gestalt is used, gradation amendment called white expanding as shown in drawing 5 can be made to act effectively.
[0040] In addition, although information, such as a white alphabetic character, was distinguished with this operation gestalt based on the magnitude of the difference of the amount of distribution between adjacent intensity levels as shown in drawing 2 , information, such as a white alphabetic character, can be distinguished as it is not only this but that the amount of distribution of a signal was set to 0 in the level of MAX value-M as shown in drawing 2 , or various approaches can be considered besides it. However, when judging that the amount of distribution is 0, it can distinguish with a more sufficient precision using information, such as a noise, without being influenced of a noise etc. by distinguishing like this operation gestalt based on the difference of the amount of distribution, although a misjudgment law may be carried out.
[0041] In addition, although information, such as a white alphabetic character, is distinguished from the MAX value detected in the 1st maximum detector 1 with this operation gestalt based on the amount of distribution of the luminance signal to an intensity level which left M pieces, if it does not tend to be concerned with a MAX value or the value of M but is going to distinguish a white alphabetic character etc., possibility of making information on subject-copy images other than a white alphabetic character into a white alphabetic character a misjudgment exception will become high. As for the value of M, in the semantics which prevents such an incorrect judging, it is desirable to set it as the value near the luminance distribution width of face of the white alphabetic character which it is going to distinguish.
[0042] (2nd operation gestalt) Drawing 4 is the block diagram showing the configuration of the image display device concerning the 2nd operation gestalt of this invention. In addition, in drawing 4 , the sign same about the same element as the 1st operation gestalt shown in drawing 1 is attached, and the explanation is omitted. An input image luminance signal is inputted into the 1st minimum value detector 7 and histogram detector 2 with this operation gestalt. In the 1st minimum value detector 7, the minimum value in every field and the display area for every frame is detected. under the present circumstances, the 1st minimum value detector 7 -- the minimum value (it considers as a MIN value below) -- in addition, the value to MIN value +L is outputted to the histogram detector 2 and the permutation circuit 4. L is taken as about two to five integer. The histogram detector 2 detects the luminance distribution information on an input image luminance signal, and outputs the amount of distribution from the MIN value inputted from the 1st minimum value detector 7 to MIN value +L to a comparator circuit 3. A comparator circuit 3 calculates the difference of the amount of distribution between adjacent intensity levels, respectively about the amount of distribution in each intensity level inputted from the histogram detector 2, and when changing a lot than the reference value B which the result of an operation can set up from the outside, it outputs the information to the permutation circuit 4. This case where it changes a lot is equivalent to detection of an intensity level

unrelated to the information on subject-copy images, such as a blanking and black of the upper and lower sides of the cinema source. Thus, when information, such as a blanking, is included in a video signal, this black information is distributed over an original image and the separated intensity level with a certain amount of width of face, as shown in drawing 5 .
[0043] Hereafter, the case where the above-mentioned L value is 3 is concretely explained to an example about detection processing of this black information. A comparator circuit 3 The amount of distribution of amount of distribution - (MIN value +1) of a MIN value (referred to as DEMIN1), The amount of distribution of amount of distribution - (MIN value +2) of (the MIN value +1) (referred to as DEMIN2), The amount of distribution (referred to as DEMIN3) of amount of distribution - (MIN value +3) is calculated respectively, and and (MIN value +2) judges that it is the brightness information projected regardless of the image, and is information unrelated to images, such as a blanking part, when the difference exceeding the reference value B set up from the outside is detected. Above DEMIN3 is large enough, and when it exceeds a reference value B, this information is outputted to the permutation circuit 4 from a comparator circuit 3. The permutation circuit 4 judges the intensity-level signal from the MIN value to the MIN value +2 to be black information unrelated to images, such as a blanking, and permutes it by the sufficiently large intensity level. As long as the level to permute does not perform gradation amendment near white, 1023 (10-bit processing) is sufficient as it, and as long as it amends white, it may also choose a middle intensity level. The output of the permutation circuit 4 is inputted into the low pass filter 5 from which isolated-point information is removed, and is inputted into the 2nd minimum value detector 8 after filtering. In the 2nd minimum value detector 8, the minimum value of a display image is detected for every field and every frame. In this way, an output minimum value signal is outputted.
[0044] According to the 2nd operation gestalt, after detecting black level unrelated to a subject-copy image like an upper example and permuting these black level by level with high enough brightness, the minimum value of subject-copy image original is detectable by detecting the minimum value again.
[0045] In addition, although the value of Above L used 3 in this example, it is necessary to set it up the optimal by dispersion in the black level of the blanking section to detect etc. Moreover, it is necessary to set up according to the black level which wants to detect a reference value B. A low pass filter 5 may perform filtering about either horizontal or a perpendicular direction, and may perform filtering in great numbers.
[0046] In this way, an example of gradation amendment using the minimum value detected by the image-processing circuit of this operation gestalt is explained using drawing 6 . In the gradation amendment shown in drawing 6 , a crease bending point is set up the optimal, and it amends so that the detected MIN value may turn into the minimum value (usually 0) of the dynamic range of a signal-processing system. It amends so that it may break into the correction value (usually 0) of the minimum value about the gradation from a crease bending point to a MIN value and a bending point may be connected. By this amendment, the gradation below the minimum value which originally was not used can be used effectively. That is, input D range is expanded even to output D range like drawing 6 . In such black stretching amendment, when a MIN value is detected smaller than a subject-copy image by incorrect detection of the black of the blanking section etc., the gradation which should be elongated decreases and the amendment effectiveness decreases.
[0047] As mentioned above, since it becomes possible to detect the minimum value of subject-copy image original according to the 2nd operation gestalt, even if it is the case where black information, such as a blanking, is included in the video signal by using the minimum value obtained according to this operation gestalt, gradation amendment called black expanding as shown in drawing 6 can be made to act effectively.
[0048] (3rd operation gestalt) Drawing 7 is the block diagram showing the configuration of the image-processing circuit concerning the 3rd operation gestalt of this invention. With this operation gestalt, the case where perform feature detection, such as maximum, from an input image luminance signal, and gradation amendment of an animation is performed based on this detected maximum is considered. An image-processing circuit is equipped with the maximum detector 20, a recursive filter 12, the APL detector 17, the APL variation detector 18, and the recursive filter control circuit 19 in drawing 7 . A recursive filter 12 contains the input through section 13, the filtering section 14, the input cutoff section 15, and a selector 16. Hereafter, actuation of the 3rd operation gestalt is explained.
[0049] An input image luminance signal is inputted into the maximum detector 20 and the APL detector 17. The maximum detector 20 detects the maximum of the image luminance signal in every field and the display area for every frame, and outputs it to a recursive filter 12. The APL detector 17 detects the average intensity level (Following APL is called) of the image luminance signal in every field and the display area for every frame, and outputs it to the APL variation detector 18. The APL variation detector 18 detects fluctuation of APL detected by the APL detector 17 for every field and every frame. The information on

fluctuation of this APL is outputted to the recursive filter control circuit 19. In the recursive filter control circuit 19, two control, control of the round multiplier of the filtering section 14 in a recursive filter 12 and control of a selector 16, is performed.

[0050] Control of a selector 16 is explained with reference to drawing 8 . The variation of APL shown in drawing 8 is expressed with the rate to the dynamic range of an input image luminance signal. For example, by digital 10bit processing, if an APL variation is 50, it is expressed with about 5% (50/1023). If U and V (positive number of the arbitration of U>V) are used, the recursive filter control circuit 19 will control a selector 16 to choose the input through section 13, when the APL variation detected in the APL variation detector 18 is U % or more. Moreover, when APL variations are U % or less and V % or more, a selector 16 is controlled to choose the filter control section 14. Moreover, when an APL variation is V % or less, a selector 16 is controlled to choose the input cutoff section 15.

[0051] In addition to the above-mentioned selection signal control, the recursive filter control circuit 19 controls the round multiplier of the filtering section 14. The configuration of the filtering section 14 is shown in drawing 9 . The filtering section 14 has covered the recursive filter to the output of the maximum detector 20. Data are updated for every field by the Vertical Synchronizing signal. After the filtering section 14 k Doubles the input from the maximum detector 20 and doubles it to the value fed back on the other hand using the round multiplier k (1-k), it adds both. The recursive filter control circuit 19 becomes large when APL variation is large, and when APL variation is small, it controls this round multiplier k to become small. The output of the filtering section 14 is inputted into the input cutoff section 15 and a selector 16.

[0052] Since according to this operation gestalt it is thought that it changed from a certain scene to another discontinuous scene when inputting the animation source, and the amount of APL fluctuation is U % or more, the information on the past maximum is completely disregarded, only the input from the present maximum detector 20 is chosen, and it outputs as an output maximum signal. Thus, by completely making information on the past maximum unrelated, gradation amendment which followed the maximum of the quick present image can be performed. On the other hand, since a scene does not change, but it is thought that it is necessary to also consider the information on past although it is change of the continuous scene (Pan of a camera etc.) when the amounts of APL fluctuation are U % or less and V % or more, the input from the filtering section 14 is chosen. as mentioned above, within the filtering section 14, when the amount of APL fluctuation is large, a round multiplier becomes large (the rate of the input from the maximum detector 20 is enlarged), and when the amount of APL fluctuation is small, a round multiplier becomes small (the rate of the input from the maximum detector 20 is made small) -- it is controlled like. Therefore, in change of the continuous scene, when change is comparatively large, the flattery nature of gradation amendment goes up, and when change is comparatively small, the flattery nature of gradation amendment falls. In addition, it is necessary to set up the transform function of the amount of APL fluctuation, and a round multiplier according to a display device. On the other hand, the input cutoff section 15 outputs to a selector the value which has stopped and memorized renewal of storage based on the control signal from the recursive filter control circuit 19, when it has memorized updating the output of the filter control section 14 serially and the amount of APL fluctuation becomes V% or less. Thereby, when the amount of APL fluctuation becomes small (i.e., when some objects change within the same scene etc.), the flicker of the display screen by gradation amendment can be prevented by losing the maximum value change to detect completely.

[0053] As mentioned above, according to the 3rd operation gestalt, according to the magnitude of the fluctuation of APL by the feature detection information on display images, such as maximum, by controlling thru/or updating stopping an input value with an output thru/or a recursive filter as it is, also in case coexistence of fine oscillating removal is enabled and an animation is displayed as the high-speed flattery nature to the display image needed, satisfactory gradation amendment can be realized.

[0054] In addition, it is necessary to set up thresholds U and V the optimal according to a display device. Moreover, although maximum was explained to the example as feature detection information, it cannot be overemphasized that the same configuration can be considered also about the minimum value.

[Translation done.]

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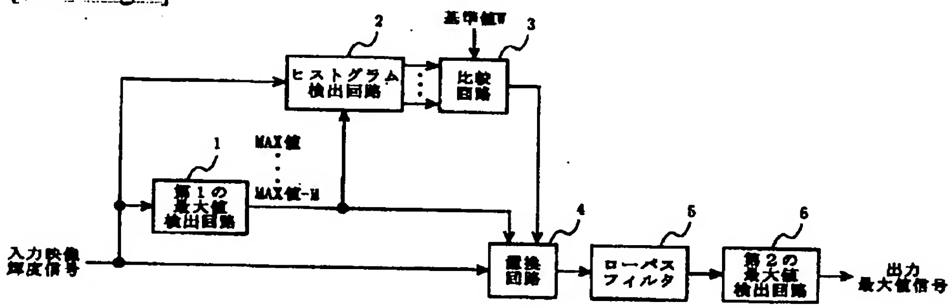
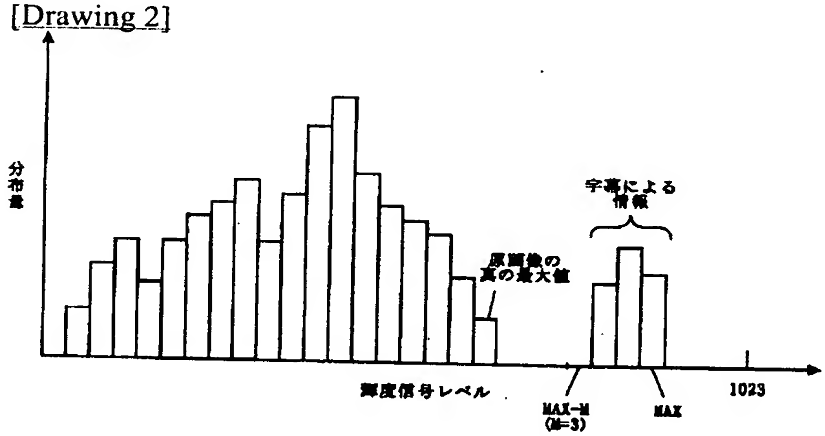
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

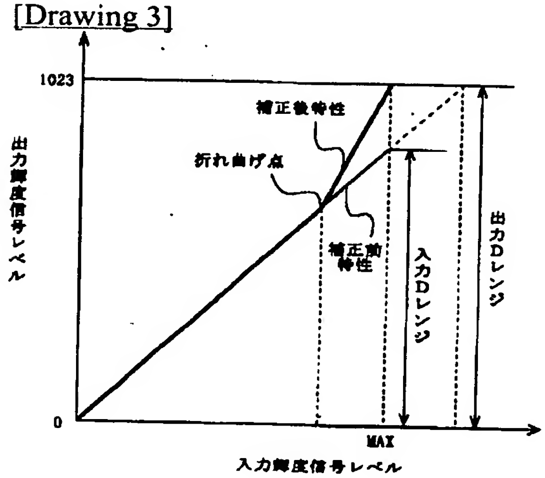
[Drawing 1]



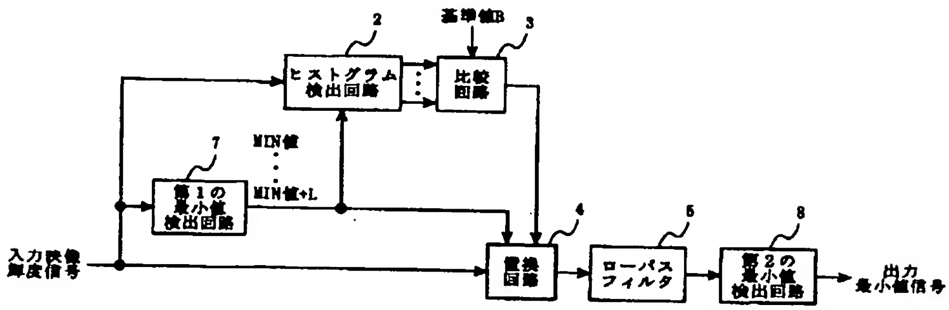
[Drawing 2]



[Drawing 3]



[Drawing 4]

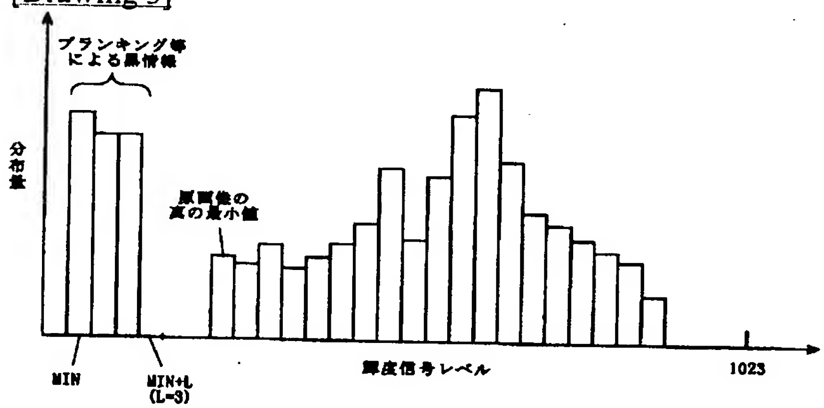


[Drawing 8]

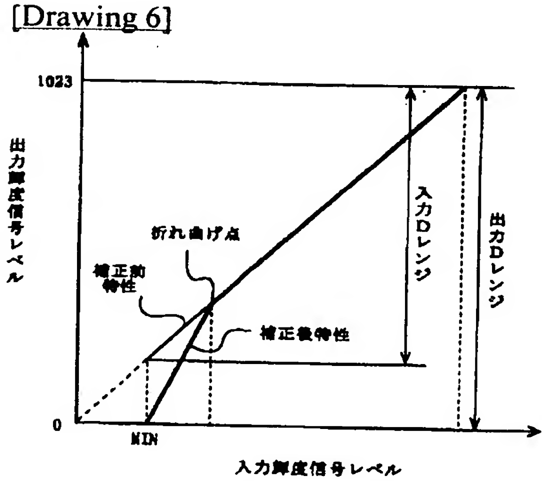
APL変動値	セレクト信号
信号DレンジのU%以上	入力スルー部13
信号DレンジのU%以下 V%以上	フィルタ処理部14
信号DレンジのV%以下	入力遮断部15

(U、V：U>Vの正の任意の整数)

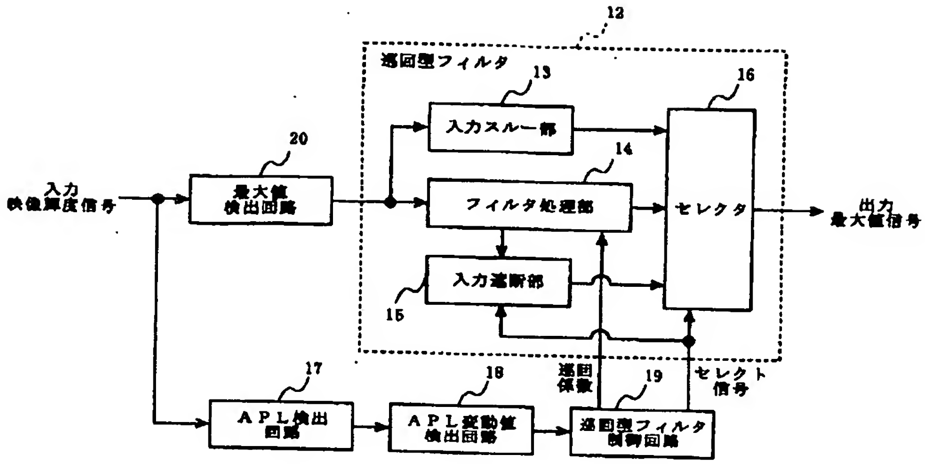
[Drawing 5]



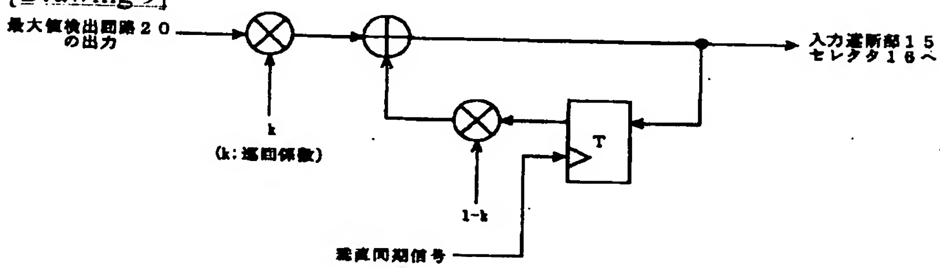
[Drawing 6]



[Drawing 7]



[Drawing 9]



[Translation done.]